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M. Thomas Blizard's
Bistoury for
Lithotomy.



AN
INAUGURAL DISSERTATION
ON
STONE IN THE BLADDER.

Submitted to the public Examination of the Faculty of Physic under the
Authority of the Trustees of Columbia College,
in the State of New-York,

The Right Rev. BENJAMIN MOORE, D. D. President;

FOR THE DEGREE OF
DOCTOR OF PHYSIC,
On the 13th Day of November, 1810.

BY HENRY U. ONDERDONK, A. M.

Member of the Royal College of Surgeons, London.

“The ancients only laid the foundation, which was doing considerable
service: they who have come after them, have worked upon their plan,
and from time to time, the art of Surgery has received improvements.”

Gataker's Translation of Le Dran's Operations.

New-York:

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1810.

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TO
DOCTOR JOHN ONDERDONK,

AS A
TRIBUTE OF FILIAL DUTY AND GRATITUDE;

TO
WRIGHT POST, ESQ.

Professor of Anatomy and Surgery in Columbia College,
and Surgeon to the New-York Hospital,

AS A
TESTIMONIAL OF RESPECT AS AN INSTRUCTOR,
AND OF ESTEEM AS A FRIEND;

AND TO
THOMAS BLIZARD, ESQ.

Fellow of the Royal Societies of London and Edinburgh,
and Surgeon to the London Hospital,

AS AN
ACKNOWLEDGMENT OF PROFESSIONAL AND
PERSONAL CIVILITIES;

THIS DISSERTATION
IS RESPECTFULLY INSCRIBED.



ADVERTISEMENT.

THE author of the following pages was led to select his subject from having witnessed at the Hospitals in London, the frequent use of a bistoury in lithotomy; and from a conviction, that it was an instrument superior in principle to any other he had seen used. But to have merely dwelt upon the merits of the knife, would not have afforded matter sufficient for an Inaugural Dissertation of reasonable length. He has therefore given a general history of the disease, for whose removal the instrument is proposed. He is sensible that much of this is mere selection; but he has endeavoured to quote from such authorities as are standard, and to adduce only such facts and observations as are of importance. These, he trusts, will compensate for any deficiency in his own remarks.

Nassau-Street, Oct. 2, 1810.



ON

STONE IN THE BLADDER.



CALCULOUS concretions are found in many parts of the body; but their most usual situation is in the urinary organs; in the kidney, ureter, bladder, prostate gland, urethra, and around the corona glandis. The nature of those found in the bladder, the symptoms they occasion, and the methods of relief, are the subjects of the present dissertation.

Calculi in the bladder vary in size, number, and composition. The most usual sizes are between those of a musket ball and a hen's egg. But they are sometimes much larger. At the lectures of the Royal College of Surgeons in London, a stone is exhibited, which weighs 44 oz. and is 16 inches in one circumference, and 14 in the other. An attempt was made to extract this by ~~Sir James Earle~~, *Mr. Blair*, but he, of course, failed, and the patient died from consequent irritation. Calculi are sometimes much smaller than the size above limited.

Commonly there is but one calculus in the bladder. Much variety however in this respect is met

with. I have seen two sets, one of 37, and another of 22, each taken from a single bladder. Dessault extracted 200 from one bladder,* which were most probably small. Mr. Home relates an instance of 350 from one patient.† When more than one exist, their surfaces are smooth. Cheselden gives a plate of two from one bladder, which had opposing smooth surfaces like a joint:‡ they had probably been retained in the bladder in such a situation that their friction upon one another was confined to these surfaces. Dr. R. S. Kissam showed me a single calculus with a small part of its surface polished, which he attributed to its lying constantly upon an enlarged prostate.

Mr. Brande, in a paper published in the Philosophical Transactions for 1808,§ has arranged urinary calculi into three kinds: Those composed chiefly of uric acid; those made up chiefly of an ammoniaco-magnesian phosphate, or of phosphate of lime, or of both; and those which contain oxalate of lime, called also mulberry calculi.

The first kind are those passed from the kidney out of the body, without remaining in the bladder at all, or only a short time. They consist of uric acid and animal matter, in proportions varying from nearly equal quantities of each, to two thirds of the former. This species are soluble in alkalies, and disappear before the blow-pipe: they have smooth surfaces, and are made up of concentric layers like a section of a tree; their colour is commonly brown,

* Parisian Journal, vol. ii. p. 386.

† Philosophical Transactions, 1808, page 244.

‡ Cheselden's Anatomy, edit. 1722, plate 30.

§ Page 223.

I have, however, seen them white. Dr. G. Pearson, in a paper of the Philosophical Transactions for 1798,* terms the acid which constitutes the base of this kind of calculus, uric oxide: he asserts that it is only found in the human subject, and may be discovered in gouty concretions, but not in those of the teeth, stomach, intestines, lungs, brain, &c. He notices some analogies which induce him to believe, that, if man lived on vegetables alone, he would not have this oxide formed in his body.—The first detection of uric acid by analysis of urinary calculus was by Scheele.

The next division made by Mr. Brande, comprehends such calculi as are principally made up of the ammoniaco-magnesian phosphate, or of phosphate of lime, or of both. These substances, he asserts, are met with when the stone has been some time in the bladder, or when a stone is detained longer than usual in the kidneys. These are commonly the most abundant ingredients in a large calculus. They are generally mixed with the uric acid, either in distinct layers, or by mechanical diffusion. Calculi formed of these alone, are found in the bladder only, and have some loosely agglutinated particles of the same matter for a nucleus. The colour of calculi of this species is a whitish grey; their surfaces frequently exhibit transparent crystals; they generally are firm, but not unfrequently so friable as to crumble under very slight pressure; they are soluble in muriatic acid. They are thought to be connected with greater disease of the bladder than either of the other species.

* Page 15.

The last division of Mr. Brande contains the few specimens which exhibit on analysis oxalate of lime. These are found only in the kidney, or are immediately passed thence. If they have been retained in the bladder, they are only nuclei for some other species. When they are passed immediately out, the patient is less liable to a return of the complaint. The surface of this species of stone is rough, not unlike the fruit to which it is compared; they are firm in texture, and difficultly soluble in acids.

The following is the result of the analysis of 150 calculi, made by this chemist. It exhibits the proportional frequency of the several species, and may afford some useful hints in considering the means proposed for dissolving a stone.

16 consisted of uric acid;

45 of uric acid as the larger, and the phosphates as the smaller ingredient;

66 of the phosphates as the larger, and uric acid as the smaller ingredient;

12 of the phosphates alone;

5 of uric acid and the phosphates, with a nucleus of oxalate of lime;

6 of oxalate of lime chiefly.

The analysis of urinary calculi was extended by Mr. Brande to those found in the brute creation. Specimens from the horse, ox, sheep, dog, hog, rabbit, and rhinoceros were examined; and the grand difference between them and the human, was, that they contained no uric acid, but carbonate of lime very generally, an ingredient not discovered in the human specimens.

SYMPTOMS.

A patient generally first experiences an itching or smarting sensation about the frenum. This induces him to rub the part frequently, and the prepuce is thus sometimes preternaturally elongated. When very violent, the sensation has been compared to cutting with a red-hot knife. A frequency in making water, together with pain, is soon observed; and this pain is particularly great while voiding the last drops, during which the bladder contracts firmly upon the stone, and undergoes excessive irritation. The pain at the glans is most acute, from that part being a centre of sympathy for the bladder and urethra; that in the region of the bladder is of a more dull nature.

A more remarkable and more certain diagnostic of the disease, is an irregularity in passing the urine. It first flows in a full stream, and then is suddenly stopped. This arises from a falling (as it is usually termed) of the stone against the mouth of the urethra. But the obstruction is rather caused by the stone being raised to this point, from the lower posterior bulging part of the cavity; into which its own gravity will incline it to subside, and which becomes obliterated while the bladder is contracting to void the urine: when the stone is raised to the point mentioned, it will be disposed to remain in the funnel-like cavity, until a new distention of the bladder allows it to subside to its first situation. This symptom occurs also in that disease of the prostate, where a part of that gland is made to project into the bladder.

Agitation greatly increases the pain from a stone. Riding in a carriage or on horseback will occasion excruciating torture, and not unfrequently cause the urine to be tinged with blood. If the bladder be particularly irritable, the mere change from a standing to a recumbent posture will give pain. These symptoms do not take place in enlarged prostate, and may serve as distinctive marks between the two diseases.

When the pain is very violent, there is often a sense of weight in the rectum, with a frequent desire to go to stool. Sometimes there are prolapsus ani, and piles. Incontinence of urine is also enumerated as a symptom. This probably arises from the relaxation of the sphincter of the bladder, in consequence of an irritation in its general muscular coat. It may also arise from the stone being so large, as nearly to fill the whole cavity of the bladder, and thus leave no room for the accumulation of urine, which will necessarily be constantly passing off. I have assisted in the examination of a patient, who died under the latter circumstances.

The urine is sometimes limpid, commonly it has a wheyey appearance, probably from the quantity of mucus it contains, and which it deposits in the form of sediment. This increased quantity of mucus is secreted, as a defence to the bladder from the irritation of the stone. After violent exercise, blood is mixed with the urine. Mucus, speckled with blood, is deemed an unequivocal symptom. A gravelly deposit is also common: it may be either the uric acid precipitated in the vessel, or a gravel of the phosphates.

When the complaint has proceeded to a violent

height, and what may be termed the latter stages have set in, the constitution will suffer from the irritation, the abdominal muscles take on a spasmodic action, and there will be frequent and violent rigors.

If the stone be small and have an even surface, it may cause the patient little or no uneasiness. And whatever be the size, the pain is not constant. It returns occasionally, making what have been termed fits. These are not regular in their recurrence, and arise most probably from the bladder being more irritable at one time than at another. They have been likewise attributed to the stone resting upon the commencement of the urethra. A stone passing from the kidney will also cause a fit. Exercise will sometimes produce it. The roughness of a calculus will also be the cause of much additional pain. A boy of about 14 years old had symptoms of stone from his infancy, but of the milder kind. A few weeks before the operation, his pain became violent. Dr. Post extracted the stone; its surface was smooth, except a portion on which some crystals had formed; these were probably of a late date, and gave rise to the increase of pain.

CAUSES.

These, at present, are involved in great obscurity. What circumstances give some persons a disposition to these concretions, while others remain exempt,

have not been satisfactorily traced. The complaint seems occasionally to be hereditary; in some cases it has been ascribed to the waters of a particular tract of country. But these explanations are unsatisfactory, in as much as their application is far from general.

Any solid substance introduced into the bladder; will form a nucleus for the concretion of a stone. Cheselden gives a plate of a calculus, formed on a bullet "shot through the upper and back part of the thigh into the bladder of a soldier."* I have seen a similar specimen in the Museum of the Royal College of Surgeons, London. There is said to be one of a like kind in a Museum at Philadelphia. Mr. Astley Cooper exhibits to his class, a calculus formed in the urethra of a sailor on a piece of wood which he had introduced while at sea, as a substitute for a bougie. In the above Museum in London, besides the specimen of bullet nucleus, Sir Wm. Blizard, in his lectures at the College, exhibited stones formed on bougies, on pins, on a bodkin, a needle, a pea, and a hazel-nut. Le Dran took a calculus from a child, formed on a dossil of lint, which had slipped into the bladder from a former operation.† In the Parisian Journal, mention is made of one whose nucleus was an "ear of corn;"‡ and of one extracted by Dessault in the Hotel Dieu, whose nucleus was a "small apple."§ And in

* Cheselden's Anatomy, edit. 1722, plate 30.

† Le Dran's Operations, page 250.

‡ The American reader may be apprised that Indian corn is not here meant.

§ Vol. ii. page 386.

some papers, published by the Massachusetts Medical Society, in 1790, a stone is described to have formed on "two or three inches of the smooth stalk of a plant, broken off in the bladder by accident."* It is also familiar to surgeons, that a silver catheter, left for three or four days in the bladder, has a calculous crust deposited on its extremity.

The consideration of these facts would induce a belief that calculi were generally deposited upon a nucleus; and in the cases where an external one was wanting, a clot of blood, a piece of hardened mucus, a small quantity of gravel, and a stone from the kidney, have been assigned; they are almost always found in the centres of calculi.

The various ingredients which make up the chemical composition of calculi, are found in the urine. Uric acid is a permanent ingredient, although "most abundant in sick people;"† the degree or nature of sickness which may produce it, is not indeed traced, but it may be owing to local diseased action, as well as to general *sickness*. The acid phosphate of lime, the phosphate of magnesia, and phosphate of ammonia, are also constant ingredients. The oxalate of lime is also found "as it were by accident." Animal matter, that is, gelatin and albumen, are likewise always present; but "very variable in their proportions in different kinds of urine." These "afford the gluten, which holds the particles of calculi together."

Calculi of uric acid, and of oxalate of lime, appear to be the only ones formed in the kidney, with-

* Page 92.

† Thompson's notes on Fourcroy's Chemistry, vol. iii. p. 321.

out a nucleus. Why this should be the situation of the spontaneous concretion of these alone, cannot be well explained; unless we suppose that uric acid, when abundant, is only mechanically diffused in the urine; a supposition which derives support from its spontaneous subsidence after urine is discharged. If such a subsidence took place in the bladder, as the particles would be very small, they would easily be washed out in passing the water, and the complaint would remain in the stage of gravel only; no nucleus being retained to give rise to a stone. If this subsidence, and consequent concretion, should take place in the tubular part of the kidney, the stone would be there wedged in, and gradually receive additional laminæ, until it passed to the bladder.

The urine is secreted in the bladder in a dilute state,—dilute, comparing the proportion of water and salts. This dilution is lessened by retention in the bladder.* The salts, of course, may then be more readily deposited; and the presence of a nucleus, will probably make this deposition invariable. Crystallization, perhaps, results from a still farther deprivation of the aqueous parts of the urine.†

There are but few data on which to ground an opinion, as to the formation of mulberry calculi. They seem to be deposited in the kidney, but on what principles I cannot offer a conjecture.

By adapting the above circumstances as may be necessary, and by bearing in mind, that in some

* Edin. Syst. Anat. vol. ii. p. 412. Haller's Physiol. p. 390.

† Admitting that uric acid and the phosphates are deposited in the manner noticed, a difference between gravel and stone may be assigned. Gravel is the deposition of these materials, previous to their having undergone aggregation or concretion; after this process has begun, the disease is stone.

eases the secretion of abundant uric acid may not be constant, we may account for the different species of calculi, whether of uric acid alone; of that mixed throughout the phosphates, alternating with them in layers, or forming a nucleus for them; or of the phosphates alone. The animal operation which yields the material, will not indeed be accounted for; but a single step towards an ultimate explanation is not without its value.

CURE.

The first analysis of urinary calculus led to the discovery of a new acid. On the ground of this discovery, alkalies were used, in the expectation, that passing by the kidneys, they might become so far a component part of the urine, as to dissolve the stone. In some instances these proved beneficial; but it was impossible, that in the greater number of cases, they could remove the concretion. By referring to the table before quoted, it will be seen that 128 of 150, contained more or less of the phosphates, which, as will presently be noticed, are rather increased than lessened by the exhibition of alkalies.

Mr. Abernethy, in his lectures, relates a singular fact, much connected with the present subject. Two portions of calculus were put into different vessels. Into one of these, the urine of a person taking alkali was frequently discharged; into the other, urine from a person not using any medicine.

The first portion of calculus in a short time crumbled, the other remained firm. This experiment proves, that alkalies can enter the circulation, and pass by the kidneys; or at least, that they can so alter the urine, as to make it capable of dissolving a stone. But in this case, the subjects of experiment were exposed to the air, an agent, which may have materially promoted the dissolution of the first.

Alkalies, however, are known to have a soothing effect on the bladder. They are useful in irritation of the bladder or kidneys. By this operation, they have probably gained their reputation as cures for the stone. Mr. Home* relates two cases of reputed cure of this disease by alkalies, in one of which were found after death 20, and in the other, 14 calculi. The symptoms he supposed to have ceased from the confinement of these stones behind the enlarged "posterior lobe of the prostate," but it is more probable, that the bladder had been rendered insensible to their presence, by the remedies employed. The formation of a cyst may also account for some cases of reputed cure.

In the opinion of Mr. Brande, alkalies may often be hurtful in this disease, at least they may increase the size of the stone. The phosphates are dissolved in urine by an excess of phosphoric acid. An alkali, by neutralizing this, may increase the deposition of these substances.

This opinion every practitioner will balance in his own mind, with the propriety of exhibiting alkalies under certain circumstances; for circumstances exist, in which they are proper. The operation is

* Philos. Trans. loc. cit.

sometimes unadvisable, and the painful situation of the patient may call for some assistance. In such a case, as alkalies have proved at least palliative, they certainly deserve a trial. Caustic alkali, with opium in linseed decoction, is a very useful prescription. Effloresced soda in pills, and soda water, are used; but are not probably so efficacious as the former, as the carbonic acid contained in them, having a stronger affinity to the alkali than the uric acid, will retain it, and prevent the chance of a solution of the stone by its uric acid uniting with the alkali. The dose of alkali is in no case to be large.

With the alkaline remedies, may be noticed lime-water. Its solvent powers are analogous to those of alkalies: how far it may prove soothing, I have no authority to determine.

Messrs. Fourcroy and Vauquelin have lately revived attempts to dissolve a stone by injecting alkalies into the bladder. They have found occasional success. But in addition to the objections to alkalies in general, this plan is imperfect, from the dilute state in which the medicine must be introduced, and the indisposition of the bladder to bear artificial distention. It is probable too, that the success has been very limited, or the method would now have more numerous advocates, as their experiments were instituted several years since.

As the phosphate calculi are soluble in muriatic acid, this has been exhibited as a remedy. It is admitted by Mr. Brande, that it possesses efficacy, so far as the phosphate materials of a calculus are concerned. But if the stone be made up in part of uric acid, or if its nucleus be of that substance, we only lose time in the experiment. The patient will de-

rive but limited benefit from a partial cure, and the operation will be as necessary after a course of acid, as before. A reference to the table will show, that uric acid is an ingredient too frequently met with, to warrant an expectation of success. Similar objections exist to the injection of this, as were noticed of alkalies.

To the practical surgeon, however, it is needless to multiply proofs of the inefficacy of *cures* for stone.* An operation becomes in almost every case necessary. And if a patient's situation does not forbid, it is improper to defer it, lest the kidneys become so diseased as to render it of no avail.

Old age does not appear to be an objection to operating. Patients above 80 have been successfully cut, between 60 and 70 frequently, and at 60 very frequently. It is not well to operate on a very young child, as untoward occurrences during the operation are more seriously felt. The youngest child on whom I have heard of its being performed with success, was a year and nine months old.

The existence of another disease in the system may forbid an operation. To add a new disturbance to a constitution in such a state, would be a great hazard of life. The other disease should be removed, and then the operation may be safely undertaken.

If there be pain in the loins, and other symptoms of a descending calculus, it is proper to wait until

* In a preceding note, a distinction was pointed out between gravel and stone. From that it will appear, that the former of these will only be known by observing the gravelly discharge. If the complaint be in this state without symptoms of stone, the exhibition of alkalies or muriatic acid may be useful.

these have subsided, that the additional calculus may be removed by the same operation.

A discharge of blood on introducing the sound, and other symptoms of highly irritable bladder, may render it prudent to wait, until, by the exhibition of alkalies and other remedies, the excessive irritability be subdued. A slight degree of irritability is no objection to operating.

SOUNDING.

No single symptom of stone is sufficiently unequivocal to warrant an operation. Nay, although the whole united may afford the highest presumptive proof of the existence of a calculus, no surgeon is justified in operating, unless he receive the more full conviction to be obtained from sounding.

Previous to introducing the sound, the urine should have been retained a few hours, that the bladder may be sufficiently distended to allow the necessary motion of the instrument.

The most convenient position is a recumbent one, with the head and chest elevated. The hip and knee joints are to be flexed, the knees are to remain asunder, and the patient must allow his muscles to be as relaxed as possible. Other positions may be necessary, but these must be regulated by circumstances.

The introduction of a sound, if there be no disease, is effected without much difficulty. The canal of the urethra is to be followed; and if the point of

the instrument be entangled in the folds of its lining membrane, or in the orifices of the lacunæ, it must be slightly withdrawn, and the attempt repeated. A large sound, in a healthy urethra, is most easily introduced.

Some have disputed whether a sound should be passed with its convex or concave side to the abdomen. The former requires a turn when the point reaches the membranous part of the urethra. This turn is supposed to increase very much the pain of introduction—a pain so great in some cases, that I heard a boy, who had been twice before cut, while on the table for a third operation, entreat the surgeon not to introduce the staff, as he feared it more than the incisions themselves. I have inquired of patients, in whom I introduced the catheter both ways, and they found no perceptible difference. From this fact, and from finding surgeons divided in opinion, it is probable that there is no very great difference between the two methods. Introducing it with the convex part to the abdomen, appears rather the easiest to the surgeon.

Stricture may prevent the passage of a sound. If this be spasmodic, a gentle pressure against the obstruction will often make it dilate. If the stricture be permanent, its cure is to be first effected.

Enlargement of the prostate will change the curve of the urethra, giving it a turn upwards. When the sound is checked at this part, a finger should be introduced into the rectum to raise its point.

The stone is often felt immediately on the entering of the sound. Sometimes it is lodged in the inferior posterior part of the bladder, so as to require a finger in the rectum, to elevate it until it strikes

the instrument. The patient's position may be varied. Or a catheter may be introduced in place of the sound, which, as it allows the urine to flow, will make the bladder contract so as to bring the stone in contact with it. Mr. J. Bell* is very strenuous in advising the introduction of a finger or two into the anus, to ascertain the relative situation of parts, and the size of the stone. But I think, that a surgeon should rely with caution on information so indistinctly obtained.

Mr. Abernethy relates in his lectures, that a patient was obliged to introduce a catheter every two hours for several years, to discharge his urine; but never discovered any stone. Seven were found in his bladder after death.

Dessault† records a case, in which the operation was performed after (as the surgeon and his assistants thought) having felt and heard the stone by the sound. When the forceps were introduced, they could not be opened to grasp the stone. A scoop was passed in to assist the extraction, and made the noise of two hard bodies in collision; but no stone was extracted. On examination, "no stone was found to exist; but the bladder was found compact, cartilaginous in its circumference."—It is reported of Mr. Cheselden, "that in the course of his practice, which indeed was very extensive, three patients were cut by him in whom no stones were discovered, and where a schirrous or hardened state of the bladder had given rise to the mistake."‡ These cases

* Smith's Abridgement, page 174.

† Parisian Journal, vol. ii. p. 125.

‡ B. Bell's Surgery, vol. iii. p. 164. Troy edit.

cannot render the feel of a stone in sounding a less reasonable ground for operating.

It must be held as an invariable maxim, never to operate unless the stone be felt by the staff, when introduced for the operation. Cases have occurred, in which the stone has slipped between the fasciculi of the muscular coat of the bladder, and carrying with it the internal membrane, has formed a sac, separate from the general cavity of that viscus. Mr. Home, in the paper above quoted, states that he has frequently met with them, even two, three, or four in one bladder, and each containing a stone. Dr. Smith, in his notes on J. Bell's Surgery, mentions that he has seen one.* In Mr. Abernethy's collection, I have seen such specimens. When in such a sac, a stone is not painful; and as the sac may be formed between the times of first sounding and of operating, it would be unjustifiable to hazard the patient's life, for the removal of a disease which was to be no longer troublesome. These sacs have sometimes prevented the extraction of a stone after an operation for that purpose. Dr. W. Moore related to me an instance of this, which occurred to the late Dr. J. Jones of this city. The nature of the case, and the existence of the sac, were made evident by examination. An operation similarly unsuccessful occurred lately in this place. An examination of the patient could not be procured; but as it was a child, the not finding the stone arose more probably from its being in a sac, than from a disease of the bladder resembling that in Dessault's and Cheselden's cases. These are cases which ought

* Page 187.

not to prevent us from deeming the sound a sufficient test of the propriety of an operation, as the circumstances, from their nature, are not within the knowledge or control of the surgeon, and as we know of no test equal in certainty to this instrument.

ANATOMY OF THE PARTS CONCERNED IN THE OPERATION.

In lithotomy, as in all other operations, an accurate acquaintance with the parts through which incisions are to be made, is absolutely necessary. A moderate share of anatomical knowledge has indeed sufficed for some operators. Thus Frere Jacques is said to have performed the operation, “without any direction and without any knowledge of the parts he was to cut;” his patients “were found with the bladder cut through, guts wounded,” &c.—The only means of giving a humane operator confidence, is a *perfect* “knowledge of the parts he is to cut.”

It will be readily seen, that mere description of the anatomy of these parts, will not convey an adequate idea of them. Dissection alone can do this.

A point in the perineum, just below the bulb of the urethra, is to be considered the centre. From this, the transversi perinei, accelerator urinæ, and sphincter ani muscles proceed. The transversi perinei are reckoned two; they are given off laterally from this point, and are inserted into the tuber ischii. The accelerator urinæ sends its fibres diverging up-

wards; and the sphincter ani goes diverging downwards. The erector penis arises from the tuber ischii, and runs upwards and slightly inwards upon the crus of the penis.

The bulb of the urethra is just before a perpendicular let fall from the arch of the pubis. Directly behind it is the membranous part of that canal. Mr. Wilson, a teacher of anatomy in London, has described two muscles "of a triangular shape, united below by a common tendon, but having each a separate tendinous attachment to the symphysis pubis, and which are so placed as to surround the membranous part of the urethra."* After leaving these muscles, the canal enters the prostate gland, being completely surrounded by it. Here it is called neck of the bladder. While leaving the prostate, it receives an indistinct sphincter of muscular fibres from the general coat of the bladder; it then opens into that cavity.

The rectum lies close behind the bladder, connected with it at the inferior part by a loose cellular and ligamentous substance. This, at its lower end, is supported by the levator ani muscle; which also surrounds the neck of the bladder, prostate gland, &c. and lies at its anterior edge, in contact with Mr. Wilson's muscle.

The vesiculæ seminales lie between the bladder and rectum. They proceed from the posterior part of the prostate, in a diverging manner, backwards. The vasa deferentia lie within them. The cut of lithotomy is made anterior to these, sufficiently so

* Medico-Chirurg. Transact. p. 176.

to avoid their ducts, which empty at the lower surface of the neck of the bladder.

Three arteries may be enumerated as concerned in lithotomy, the internal pudendal, the artery of the bulb, and the transverse perineal. The former of these runs along the ramus of the ischium, exterior to the levator ani muscle, and rather within the edge of the ramus. It gives off the transverse perineal, which follows the transversus perinei muscle. At the root of the penis it gives off the artery of the bulb, and is then lost in the dorsal and central arteries of the penis.

The parts cut through in the lateral operation, are these: 1. The common integuments and cellular membrane; 2. The transverse perineal muscles and artery; 3. The membranous part of the urethra, with Mr. Wilson's muscle investing it; 4. The neck of the bladder, and a side of the prostate; 5. The sphincter of the bladder, and a small portion of its parietes.

This enumeration of parts cut through, is given on the supposition that we direct our incision, first to the fore part of the prostate, and next to the membranous urethra. But the more ordinary course is to the bulb of the urethra; in which case, that part, its artery, and perhaps a small portion of the accelerator urinæ, are divided in addition to the parts just mentioned. There is no farther impropriety in this, than that the operation is not so neat, and that an additional artery is divided.

The internal pudendal artery is not divided unless it vary its situation, lying nearer the centre of the perineum, or the incision reach very far to one side. It is frequently cut by Mr. Cline's gorget.

The operator cannot expect to see all the parts through which he cuts. The blood from the vessels of the integuments will probably conceal them: when the transverse perineal artery is divided, they will certainly be hid. An accurate anatomy will now be especially useful. The finger must be the guide; "it is only by feeling opposition and stricture that we recognize the transverse muscle;" and the chief direction for finding the membranous part of the urethra, is the groove of the staff.

The axis of the pelvis is a line drawn from the extremity of the os coccygis to the umbilicus. The axis of the bladder is a parallel line, which, for practical purposes, is to be considered as beginning at the commencement of the urethra. This imaginary line, it is of the highest importance to remember, as it is the direction in which the instrument is entered for making the second incision. Either from ignorance of this anatomical point, or from neglecting it in practice, have arisen most of the accidents of the operation.

OPERATION.

It would swell this thesis uselessly to recapitulate the different methods which have been proposed for extracting a calculus from the bladder. Nay, it would require a search of no small extent, to discover the whole. Some have become obsolete from not bearing the test of experiment, and some have

rested in the undisturbed narratives of their inventors. The only method now used is the lateral operation. This in the first incision is the same in all cases—the second incision varies, as it is made by a gorget or bistoury.*

The patient is to be prepared for the operation by reducing his habit, if it be plethoric, by low diet and an occasional purge. If he be already debilitated, he is to be restored by generous diet. The occasional introduction of the sound, to accustom the urethra and bladder to its irritation, is recommended by Mr. Astley Cooper in his lectures. Previous to operating, the rectum is to be emptied by an enema or gentle cathartic, to allow it to be as little distended, and consequently as distant from injury as possible. The urine should, as in sounding, be retained for a few hours.

The hands are to grasp the soles of the feet, and the patient is to be bound in that position. Some use an additional bandage, passing from the neck

* I ought, perhaps, to apologize for omitting the variety of the lateral operation invented by Mr. Cheselden, and sanctioned by Mr. J. Bell. It consists in continuing the external incision, until the scalpel divides the “sides of the bladder, immediately above the prostate,” and in drawing it “firmly and steadily towards him (the surgeon), pressing the knife into the groove of the staff,” till “the gland and cervix vesicæ are divided.” This operation one would be led to imagine the best, as it has received the approbation of such eminent surgeons; but those less *renowned* do not seem to favour it, and Cheselden himself abandoned it for the gorget in his third manner of operating. It certainly is more complicated, and leaves a more ragged wound; and if the bistoury proposed should not be liable to the objections to the gorget, none, I trust, will question that the incision *from* the centre of the perineum, is preferable to that *towards* it. For accounts of this operation, the reader is referred to the papers relative to Mr. Cheselden’s methods, collected and republished by Dr. Thompson of Edinburgh; to Cooper’s *First Lines of Surgery*; and Smith’s *Abridgement of J. Bell’s Surgery*, page 181.

under the knees, to limit still farther the struggling. The patient's buttocks are to be brought just over the edge of the table, the knees kept asunder, and the body supported by assistants; the perineum is to be exposed to a good light, and shaved if necessary. The staff is to be introduced by the surgeon, and given to an assistant, who holds it firmly with the curve of it pressing gently outwards the left side of the raphe, just below the scrotum. With his other hand the assistant supports the scrotum.

As the operation is usually performed, the incisions are made by two instruments. This makes a natural division of the operation into two incisions, the first or external, and the second or internal incision.

The operation is begun, by entering a scalpel near an inch behind the scrotum, on the left side of the raphe, over the part where the staff is felt; this incision is to be carried in a direct line till it be an inch past the anus, midway between that and the tuber ischii. The cellular and ligamentous substance, with the transverse muscles, are to be divided by a continuance of the incision, directed towards the prostate, with the rectum kept out of the way by such of the surgeon's fingers as are not otherwise employed. The bulb of the urethra is to be avoided, and when the finger can distinguish the groove of the staff so plainly as to be certain that the membranous urethra only is between them, this is to be divided upon the staff: it is to be divided by one bold stroke; a repetition of cuts will endanger a loss of substance, and according to Mr. J. Bell,*

* Smith's Abridgement, page 186.

may contribute to the forcing “ off the neck of the bladder and prostate from the urethra” by the gorget. The cut into the membranous part of the urethra terminates the first or external incision.

The second incision is done in two ways. 1. An instrument is thrust in, which makes its incision in entering. 2. A bistoury is introduced, in withdrawing which, an incision is made, regulated in size by the judgment of the operator.

The most used instrument of the former class is the gorget. This is to be fitted into the groove of the staff, and thrust along it to the bladder, in the direction of its axis, until the flow of urine assures us that it has entered that viscus. The staff is then usually withdrawn, the forceps introduced on the gorget as a director, and the latter instrument also removed. The stone is then felt for, and extracted. The gorget is of various forms. As instruments on the same principle, may be reckoned, the scalpel as spoken of by Sharpe,* and used by Mr. C. Bell, and the beaked scalpel as formerly used by Mr. A. Cooper. When either of the latter instruments is used, the staff is to remain in, the scalpel to be immediately withdrawn, and the finger introduced upon the staff, both to ascertain the place and size of the stone, and to serve as a director for the forceps. This practice indeed is preferable in using the gorget; it lessens the risk of cutting through the sides of the bladder. It was introduced formerly in the London Hospital by Mr. Thomas Blizard; and as the gorget was no longer to serve as director to the forceps, he had'it made with its han-

* Operat. Surg. p. 96, edit. 1782.

dle continued in a line with the blade. This direction gave the instrument obvious advantages.

Of the second description of instruments, those of Mr. Astley Cooper, and Mr. Thomas Blizard, appear the most perfect in principle. That of the former is a curved bistoury, with a beak projecting from its point. That of the latter is a straight bistoury, rounded for three fourths of an inch from its point, with a beak slightly turned up to be more readily fitted into the groove of the staff.* The incision by these instruments is made, as was stated, in withdrawing them. The finger is then to be introduced upon the staff, and that instrument withdrawn; the situation, and, if possible, the size of the stone are to be ascertained by the finger; the forceps is to be introduced under its guidance, and the stone grasped. A minute point, but one of some importance, should next be attended to; the forceps is to be turned, that the surgeon may be certain that no fold of the bladder is entangled in its grasp. This ascertained, the stone is to be extracted by a continued force, united with a motion of the handles of the forceps upwards and downwards, considering that instrument as "two levers." When the stone is taken away, a finger is to search the bladder lest there be more.

If the wound in the bladder be not large enough to extract the stone, it must be dilated by a probe-pointed bistoury. If an extensive incision be required, the opposite side of the bladder is to be cut

* The plate at the title page represents this instrument. One view shows the form of the blade and the rounding of it towards the point. The other shows the elevation of the beak. The handle should be made rough for a more secure grasp. The figure is of the exact size of the instrument.

with the same instrument. If the stone be too large to extract whole, it should be broken. To this practice we are led by a comparison of chances of the patient's recovery, rather than by a grounded hope of such an event.

Calculi sometimes adhere to the bladder, i. e. a fungus shoots from the internal surface of that viscus, which fixes upon the stone. It may absorb portions of it, and enter the crevices thus made. There can be no hesitation as to the propriety of removing the stone, if possible. Death is certain if it be left; at least it will be so if an unsuccessful effort has been made with the forceps. Vigilance to prevent abdominal and vesical inflammation, after such a calculus is taken away, may afford the patient a chance of recovery.

After extracting the stone, the surgeon is to attend to the hæmorrhage. If this be trifling, we may conclude that no vessel likely to cause danger has been cut. If bleeding arteries be at all conspicuous, they ought, if possible, to be tied. If this cannot be done, and the hæmorrhage be troublesome, pressure should be made. This would be best done by the finger of an assistant; but as it must be continued some days, and as a change of assistants will endanger a renewal of hæmorrhage, the use of a canula will be found an eligible substitute. This is much dwelt upon by Le Dran, and I have seen it used successfully by Dr. Post.

The dressing of the wound is a matter of minor importance. Little difference in the cure takes place whether it be dressed or not. The scrotum should be supported, particularly if a canula is used. The patient's stomach is liable to be out of

order by his complicated sufferings. Mr. Abernethy is particular in directing the attention of his class to this. He recommends the occasional exhibition of a few grains of the pil. hydrarg. and of a gentle purge. The latter will be particularly serviceable, if lying in bed render the patient costive.

“ The first good symptom after the operation, is the urine coming freely away, as we then know the lips of the bladder and prostate are not much inflamed, for they often grow turgid, and shut up the orifice in such a manner, as not only to prevent the issue of the water, but even the introduction of the finger or female catheter, so that sometimes we are forced to pass a catheter by the penis. From this symptom too, we learn that the kidneys are not so affected by the operation as to cease doing their office; which, though a very rare circumstance, may possibly occur.”* The urine coming *freely* away, is also a proof that clots have not formed in the bladder. This cavity is sometimes a reservoir for the hæmorrhage, and the blood will entangle a considerable quantity of urine with it in coagulating. It is this entangling of the urine which makes the clots so large, rather than blood “ collected in great quantities in the cavity of the bladder.” The existence of these clots is known by a want of a “ *free* discharge of urine,” and when large, they occasion pain and swelling of the abdomen, and fever. As soon as their existence is suspected, the surgeon should introduce his finger, break them down, and procure a complete evacuation of them. As a preventive, the patient

* Sharpe's Operations, page 99.

should lie with the wound rather depending, that all effused blood may pass outwardly.

Peritoneal inflammation is a very frequent cause of a fatal event after lithotomy. This is known by the frequent and rapid pulse, and the tenderness over the abdomen. As soon as these symptoms appear, both local and general blood-letting are to be largely employed. The warm bath is an essential; fomentations are to be made externally, and internally by clysters. The bowels are to be kept open by full doses of the *ol. ricin. com.*

A violent and fatal constitutional irritation sometimes takes place after lithotomy. Mr. T. Blizard related to me several cases of this kind: he recommends a large opiate to be *invariably* given, as the irritation is more certainly fatal than that occurring after any other operation. The opiate is indeed the *usual* prescription immediately after every capital operation, but the considerations noticed should make it a *constant* one after lithotomy.

The bladder is frequently more or less irritable previous to operating. If this should continue or increase afterwards, opiate clysters are to be resorted to. This occurrence is chiefly in old patients, and is not easily subdued by any remedies.

When there is no untoward occurrence, the urine commonly passes through the wound for a fortnight, three weeks, or a month. At the expiration of this time, it is in most cases healed. Sometimes the separating of sloughs will protract the cure; and occasionally the passage continues fistulous.

Calculi seldom form after an operation; the nucleus is taken away, and the patient may escape a second. All, however, are not so fortunate. A case

was before mentioned of a boy operated on the third time. At this last operation, two stones were taken from the perineum, and one from the commencement of the urethra. The latter had taken on the form of that canal. Those in the perineum got there probably from the bladder, or may have been deposited from the urine, as it passed that situation through sinuses consequent to the former operations. This was performed by Mr. Astley Cooper. In cases like this, it may sometimes be proper to cut on the right side of the perineum.

CIRCUMSTANCES OF PECULIARITY IN THE FEMALE.

The operation of lithotomy is less frequently necessary in the female than in the male. The urethra is shorter, larger, and more dilatable. Consequently stones of considerable magnitude will occasionally pass.

In the *Medico-Chirurgical Transactions*,* a very instructive case of artificial distention of the female urethra is related by Mr. Thomas. His patient had laboured under retention of urine, and as no regular assistance was at hand, had "an ivory ear-picker" introduced. This let off a part of the water, but unfortunately slipped in. From an unwillingness to have an incision made, Mr. T. was induced

* Page 123.

to use the sponge tent to dilate the passage. This he in the end effected; he introduced his fore-finger, and extracted the ear-picker. He adds, "I believe, had the case required it, both thumb and finger would have passed into the bladder without the smallest difficulty."

Mr. Thomas quotes other similar cases—one in particular, from the Philosophical Transactions, of a stone voided by a woman, "the circumference of which measured the longest way $7\frac{6}{16}$ inches, and round about where it was thickest $5\frac{1}{4}$ inches, its weight near $2\frac{1}{2}$ ounces troy."

These facts sufficiently explain why females less frequently become subjects of this operation.

In addition to the symptoms enumerated as occurring in the male, there will be a bearing down of the uterus, and excessive pain at the meatus urinarius. But in the female, as in the male, the surgeon is to trust only to the actual feeling of the stone. He should also be particular that he *introduce* the sound himself. Cases have occurred where, from regard to false delicacy, a surgeon has permitted his patient to introduce it, and he has been deceived when feeling the grating sensation, by the sound rubbing upon a pebble, or other extraneous substance, introduced into the vagina.

The operation in the female is particularly simple; the whole of what was termed the external incision is here unnecessary. The staff is straight, a common probe-pointed bistoury is to be introduced in its groove, and a slight lateral incision made; the finger is to be passed in, the forceps along this, and the stone extracted, as in the male. There will not probably be any artery requiring ligature.

It is a disputed point, whether lithotomy should ever be performed on a female. The dilatability of the urethra, it is alleged, will make an incision unnecessary "in a young and healthy female subject, where the bladder is free from disease."* One obstacle will present equally to both methods; incontinence of urine very frequently occurs after both. In Mr. Thomas' case "the involuntary discharge of urine continued only six hours," but in some cases it has undoubtedly been far more obstinate. The surgeon's decision between the two methods must be guided by the state of the bladder, and the probable size of the stone. If the former be diseased, and the latter very large, it would be improper to hazard a destruction of the muscular power of the urethra, by over-distention, and an incision would be preferable. If the bladder be sound, and the stone reasonably supposed to be small, the trial of dilatation would appear to be the most eligible practice. This at least is the opinion of Le Dran.† I need offer no apology to modern surgeons, for not dwelling upon his means of dilatation, the blunt gorget and several forceps increasing in size. This author adds,‡ "Women are more subject to this complaint (incontinence of urine) than men, as in them the neck of the bladder is not invested with the prostate gland, which strengthens that part. It is impossible to avoid either dilating or dividing the orifice of the bladder in order to extract the stone; and when the stone is large, it must necessarily make a dilatation and laceration proportionable to its bulk, or it could

* Mr. Thomas' paper, loc. cit.

† Page 255, edit. 1781.

‡ Page 265.

not pass. This is indeed a great misfortune to the sex, but the only method to prevent it is to have recourse to the operation in time, before the stone is arrived to any considerable size."

INSTRUMENTS.

Certain accidents not unfrequently occur during the operation, which should make the surgeon very careful in his choice of instruments. Some of these untoward occurrences may be the effect of a want of anatomical knowledge, or of proper caution. But it is evident, that some must be occasioned by using a faulty instrument. My remarks on this head shall be entirely confined to a comparison between the gorget and bistoury. These are the instruments which chiefly divide the opinions of surgeons at present.

The accident most generally feared, is the thrusting the gorget between the bladder and rectum, in making the second incision. This, it may be said, cannot take place if the instrument be passed in the direction of the axis of the bladder. As I have not witnessed the occurrence, I cannot say whether this point has been attended to. But it has happened in the hands of surgeons who had a large share of public confidence, and whom we cannot reasonably suspect of deficiency. The accident is not so unfrequent as has been imagined. Mr. C. Bell relates that

he has known it in two cases;* Mr. A. Cooper, in his lectures, states, that "near a dozen" instances have come within his knowledge; and I have myself been informed of others.

This occurrence has been explained by Mr. C. Bell from some appearances observed on the dead body. "The gorget had not gone off the groove: it had only not cut the neck of the bladder, it had pushed the prostate gland onwards upon the staff, and had not pierced the neck of the bladder nor the prostate gland."† Mr. J. Bell probably has this explanation in view, when he speaks of forcing "off the neck of the bladder and prostate from the urethra;" but he also thinks it "unquestionable that the gorget is often plunged among the viscera."‡ The probability is, that all these varieties of the accident may occur.

The explanation of the Bells would place the fault of such an accident rather in the instrument than in the operator. And indeed, whatever explanation we adopt, it must be evident, that the gorget is very liable to cause such an occurrence; not to say, that it appears calculated for it. A kind of curve is described in thrusting it in, which must make it act with obvious disadvantage; its edge striking obliquely, will probably lacerate as many fibres as it cuts. In the use of the bistoury however, no such occurrence takes place. It is so small that it passes with the readiness of a sound, and as the incision is made in withdrawing the instrument, it is impossi-

* Operat. Surg. vol. i. page 344.

† Ibid.

‡ Smith's Abridgement, pages 186, 187.

ble that the prostate can yield before its edge. Not to mention that the edge of a knife can be made and kept keen with far greater ease than that of a gorget, and will of course be better calculated to make a real *incision*. We cannot suppose it possible, but by the grossest ignorance or inattention, that the *bistoury* can be literally pushed between the bladder and rectum.

Cases have occurred, in which the staff has been bent by an over-attention to keep the beak of the gorget in its groove. In the use of the *bistoury*, this is scarcely possible; it enters with such facility, that no *force* is requisite to keep its beak in contact with the staff.

The gorget being an instrument of no inconsiderable bulk, must be wedged with some firmness in the wound it makes. This will prevent the operator from feeling with accuracy when it has entered the bladder; or rather, (as the flow of urine will ascertain this) he will not be able to command the force with which he thrusts it onward. This accident is admitted by "those who prefer the gorget, and regard it as the ultimate improvement of this operation." It has occurred to surgeons whose caution or knowledge we have no reason to doubt, and it must therefore be, at least in part, attributed to the instrument. I need hardly add, that the *bistoury* is free from such an imperfection; it passes like a probe, and is as easily regulated by the surgeon; and even were it *thrust* in, it would be scarcely more liable to pierce the bladder than a sound.

The above accident may perhaps be attributed to the bladder's contracting upon the edge of the gorget. This edge, in every form of that instrument

and those analogous to it, projects; which projection, if the stone be not between it and the coats of the bladder, may very readily cut through the latter. It is evident, that the bistoury is not liable to this accident, as its edge does not project.

It may perhaps be objected to the bistoury, that it gives no limit to the incision. It truly does not; and to a surgeon even moderately expert, this would be a recommendation rather than an objection. I am not indeed certain that any will cavil; if they should, they must be referred to the *dead* subject, till they can acquire steadiness sufficient to handle a knife.

The gorget, it will be urged, unites a director with a cutting instrument. It was before stated, that the advantage of such a director was very questionable. If the wound be sufficiently free, and the patient's struggles not unusually violent, the finger upon the staff, and the forceps upon the finger, will fully suffice. If the patient be very fat, his bladder may be too far from the external perineum, to be reached by the finger. Or the surgeon, however expert, may possibly lose the direction of the incision. In this case, a blunt gorget will be an useful instrument. But the occasion for a director will be very rare, and the bistoury in all other cases will amply suffice.

I am sensible, that although the knife is preferred by surgeons of great eminence, the gorget has advocates equally great. With so even a defence on both sides, it might be deemed presumption to offer an unreserved decision. So far however as I am acquainted with the opinions of each, I am disposed to think that the bistoury is liable to fewer objections

than any other instrument with whose use I am acquainted.

Thus far the knives both of Mr. Blizzard and Mr. Cooper have been equally advocated; and from the similarity of principle, it would be difficult to choose between them. There are however some *minutiæ* in that of the former, which will make it, on the whole, preferable; or perhaps I may think so, from being accustomed to its use on the dead body. As its beak projects a little from the upper part of its point, it may be introduced more nearly parallel with the staff. As it is rounded for near an inch from the beak, it will follow with greater certainty the canal of the urethra, and will "make assurance doubly sure," that the parietes of the bladder will not be cut. As also it is straight, it is better calculated to make a ready incision.

These instruments have both been repeatedly used with success; so that no circumstance, either in theory or in experiment, is wanting to embolden a surgeon in adopting them. Of operators, however, who have long used the gorget, and who are satisfied with their practice, it would be unreasonable to ask a change. A younger surgeon will balance in his own mind the comparative merits of the two; and as he has "proved" neither, will adopt that in which he places the greatest confidence. The first duty of every practitioner is to render operations unnecessary. When these efforts are unavailing, he is to free them from danger as much as possible. Anatomical knowledge, and well-established theory, are undoubtedly the most important means of effecting the latter; but it must be evident that there is a preference among instruments,—in what operation

more than in lithotomy? It has been advanced, that the gorget is a knife; if so, it is a very clumsy one. The use of such an argument is a tacit consent to the superiority of the latter instrument. And I know not what higher praise could be bestowed upon the bistoury, than retorting, that it is not a gorget.

THE END.





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